Summary

The Geographical Distribution of the Murid-Genus Hylomyscus on Fernando Poo and in Western-Cameroon

Taxonomic clarifiaction of the *Hylomyscus*-forms from W-Cameroon and Fernando Poo. In both territories *H. aeta aeta* occupies the medial and higher mountainous zones. From the Oku-Mountains (Banso-Highland) the race *H. aeta grandis* ssp. n. is described, characterized by large body and skull measurements. *H. alleni,* in form of the race alleni, occours in the low-lands area of Fernando Poo and of the Cameroon-Mountains. In the higher mountainous zone of the island there lives a mountainous race, *H. alleni montis ssp. n.,* which is also found on the continent in the Oku-Mountains. *H. stella* is widely distributed as well on Fernando Poo as on the continent H. aeta has the number of chromosomes: 2 N = 52, *H. allensi montis* 2 N = 46, *H. stella* 2 N = 46. Finally breeding and crossbreeding experiments are reported.

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Some Remarks on Horse Evolution and Classification

By P. Y. Sondaar

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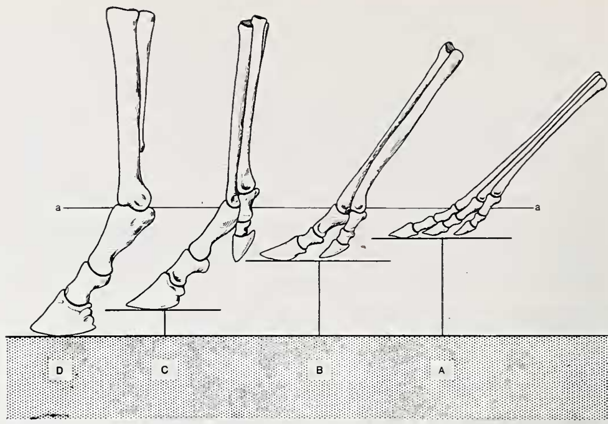
The main outlines of equid evolution are better known than those of most other groups, and they are used in textbooks of natural sciences as an example of the process of evolution. This is mainly due to the fact that there is a wonderful sequence of fossil horse material in rocks dating from Eocene till recent, especially in North America. In this material we can follow some evolutionary trends very clearly as for example increase in size, reduction of lateral digits, and increase in hypsodonty from *Hyracotherium* to *Equus*.

Some major facts of this evolution, however, have sofar insufficiently been studied or have been misinterpreted, some of which may be mentioned here:

1. relative lengthening of the central phalanges and by it, the lift of the foot from the ground, which had biodynamical consequences and changed the whole system of locomotion (Sondaar, 1968).
2. the position of the foot during locomotion and at rest. In studies about the evolution of the horse the foot of the fossil ones is placed in the same as found in *Equus* at rest. In this position the foot of the fossil horses is compared with the recent one and speculations have been made about the function of the lateral toes. Studying the articulation joints of the fossil horses (Sondaar, 1968) the author noticed that such a position must have been unnatural for an animal like *Mesohippus* and *neither* occurred during locomotion nor in rest position of the animal. At rest the metapodials of *Equus* are about perpendicular to the ground while in *Mesohippus* those bones make an angle of about 50° with the ground plane and in consequence the lateral digits will touch the ground. It is of interest to note that the preparators placed the foot of *Mesohippus* in this position when they had to reconstruct it with original material.



Horse front foot in rest position — A = *Hyracotherium*, B = *Mesohippus*, C = *Hipparion*, D = *Equus* — a: line drawn through the fetlock joint — For comparison the feet are brought to the same size (length of the central metapodials is in four feet the same). Clearly is seen the change in position of the lengthening of the central phalanges from *Hyracotherium* to *Equus*

These two changes, the lengthening of the central phalanges and footposition were of the first importance for the further horse's evolution. It changed the ecological possibilities of the horse which could occupy now another biotope.

These changes were clearly noted for the first time in *Archaeohippus* and *Parahippus*. In these two horses we can see also for the first time a further specialization in the teeth which start to become hypsodont. Important changes can be noted also in the lateral metapodials which are more tightly bound to the central and acted as one bone. The flexibility of the fetlock becomes greater in anterior – posterior direction and restricted in lateral direction.

It is of interest to point out here a parallelism in European horses, namely the Oligocene genus *Plagiolophus* which had already quite hypsodont teeth, but developed another way in foot specialization. The phalanges remained short and the animal must have had clear pads. The flexibility of the fetlock joint was reduced in anterior-posterior direction but the flexibility of the carpal joint was greater than in American horses. Speculating we may perhaps say that this specialization was not as effective as the solution the American horses found for a better locomotion in an open country, and though European horses introduced the hypsodonty, the locomotion remained behind this development and the animal could not survive the competition with the artiodactyls. Considering now the history of the horses in North America we can distinguish four different types in this locomotion:

I. That of "*Eohippus*" and *Orohippus* with four toes on the front foot and three on the hind foot. The four metapodials could still act independently. The foot had clear pads. At rest the metapodials made an angle with the ground.

II. *Mesohippus* — *Anchitherium* — *Hypohippus*. The locomotion of these horses was characterized by a functional tridactylism on front and hind foot. The foot had clear pads. The central phalanges were relatively short. The lateral metapodials could act to a certain degree independently of the central and were specially on their distal end free from the central. The flexibility of the fetlock joint in anterior-posterior direction was restricted and some lateral movement in this articulation joint was still possible. The position of the foot during locomotion and at rest were clearly different from that of the recent horse (at rest the angle between central metapodial and ground was in *Mesohippus* ± 50° and is in *Equus* ± 90°). In consequence the laterals always did touch the ground and were functional also in rest position.

III. *Archaeohippus* — *Parahippus* — *Merychippus* — *Hipparion*. In this type of locomotion we find functional tridactyl feet. A clear lengthening of the central phalanges is noticeable and by the lift of the foot from the ground it lost its pad. The position of the foot is already more like that of the recent horse and the action of the limbs is more pendulum-like. We find a more complex digital ligamental system to support the fetlock joint on which more strength was brought by the lengthening of the phalanges and which became more flexible in anterior-posterior direction and less in lateral. The lateral metapodials were tigthtly bound to the central and did act as one bone. There was still an interosseous muscle (SONDAAR, 1968) which perhaps could regulate the position of the foot to a certain degree. Speculating, we may say that on soft ground the fetlock could be bent a little more and the laterals were then functional also at rest. When the animal was running on hard ground the function of the laterals was perhaps only to prevent too much dorsal flexion but they mostly did not touch the ground. The possibility of active regulation of the foot position gave this group of horses an "allround" type of foot, but the endurance of the animal must have been less than that of the next group.

IV. *Pliohippus* — *Equus*. Here we find the so called "monodactyl springing foot type". The laterals are no longer functional and are lost. The interosseous muscle is degenerated to a tendon and the so-called springing ligaments (CAMP and SMITH, 1942) are extremely developed. The fetlock joint is at rest far from the ground, the phalanges are relatively long. Together with a maximum flexibility in anteior-posterior direction an the fetlock and the elastic springing ligament an optimal springing effect ist obtained. CAMP and S MITH (1942) compare this with a pogo stick. This foot type is very effective in an open country on firm soil and gives the animal great power of endurance.

Within the four groups distinguished on their locomotion there are of course a number of variations and it is possible to distinguish several adaptations.

The first two types are restricted to browsers as is seen also in the chtamolodont dentitions, whereas the horses with the locomotion of type III and IV are grazers with hypsodont teeth, with perhaps the exception of *Archaeohippus* and *Parahippus* though their molars show advanced characters and start to become already somewhat more hypsodont if compared with *Mesohippus*.

With the classification of the Equidae, mainly the dental characters are used; and up till now the general accepted practice has been to put the genera *Archaeohippus* and *Parahippus* in the subfamily of the Anchitheriinae, STIRTON (1940), SIMPSON (1945, 1951) and others. MATTHEW (1932) however, did notice the big differences between the post cranial skeleton of *Archaeohippus* and that of the Anchitheriine group and states that this group belongs certainly to the Protohippine group, which opinion is also the present author's.

The change in the locomotion was the main change and must have occurred quite rapidly while the development of the hypsodont teeth started afterwards or at the same time with this change and increased gradually during the Miocene. Also in the Miocene and Pliocene the horse teeth proved to be quite variable and all kind of variations on a certain ground plane are seen (SONDAAR 1968).

For the classification it is preferable to use in this case the foot structure instead of the teeth morphology. In consequence we must restict the subfamily name of Anchitheriinae to tridactyl horses, with short central phalanges, padded feet with lateral flexibility (locomotion type II).

In analogy the change from the tridactyl "allround" foot to the monodactyl springing foot which was another important step in the evolution of the horse can be used as a criterion in the classification. It is proposed to use for these tridactyl horses the subfamily name of Hipparioninae (type genus *Hipparion* DE CHRISTOL, 1832) while the subfamily Equinae is restricted to the monodactyl horses with the springing foot type.

The subfamily Protohippinae Gidley, 1907 does not fit in this classification for the following reasons:

1. Gidley 1907 erected the new subfamily Protohippinae to replace subfamily Hippotheriinae Cope, 1881 as *Hippothericum* was antedated by *Hipparion*.
   Protohippinae did not, however, cover this subfamily, as Gidley 1907 did also include the genus *Pliohippus* (monodactyl) in this subfamily.
2. Nothing is known about the locomotion of the genotype of *Protohippus*.

Summary

Some aspects of horse evolution and classification are reviewed. Special attention is paid to the changes in locomotion in the horses.

Four different types of locomotion are distinguished within the family Equidae.

Zusammenfassung

Einige Ansichten der Evolution des Pferdes und die Klassifikation der Equidae werden revidiert.

Besondere Aufmerksamkeit wird verwendet auf die Änderung des Laufmechanismus.

Es werden vier verschiedene Typen der Fortbewegung unterschieden innerhalb der Equidae.

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Lebensbezirke und Ortsveränderungen markierter Gemsen *(Rupicapra rupicapra L.)* im Augstmatthorngebiet, Schweiz[1]

Von AUGUSTIN KRÄMER

Aus dem Zoologischen Museum der Universität Zürich — Direktor: Prof. Dr. H. Burla

Eingang des Ms. 2. 10. 1968

Anläßlich der soziologisch-ethologischen Untersuchung einer Gemspopulation, die in den Jahren 1964 bis 1966 im eidgenössischen Bannbezirk Augstmatthorn durchgeführt wurde (KRÄMER, im Druck), stand eine Anzahl sichtbar markierter Gemsen zur Verfügung, deren Beobachtung Aufschluß gab über das Dislokationsmuster und die Größe des individuellen Lebensbezirks. Die angewandte Methode erlaubte allerdings nicht, die Ortsveränderungen markierter Tiere dauernd zu überwachen, so daß auf eine eingehende Analyse des räumlichen Verhaltens verzichtet werden muß. Die hier mitgeteilten Befunde können lediglich zur vorläufigen Orientierung dienen.

Das Untersuchungsgebiet

Der eidgenössische Bannbezirk Augstmatthorn (20,4 km^2) am Nordrand der Berner Alpen ist charakterisiert durch einen isolierten Grat von 1900 bis 2100 m Höhe, der von Nordosten nach Südwesten verläuft. Die steilen Flanken sind im unteren Teil bewaldet, im oberen Teil offen mit Grasflächen, Schutthalden und Fels. Eine ausführliche Beschreibung des Gebietes findet sich in KRÄMER (im Druck).

Tiere und Methode

Zur Zeit der Untersuchung (April 1964 bis November 1966) lebten im Bannbezirk 300 bis 400 Gemsen. Insgesamt standen 39 Tiere mit künstlichen und 27 Tiere mit

[1] Mit Unterstützung des Schweizerischen Nationalfonds zur Förderung der wissenschaftlichen Forschung, der Schweizerischen Stiftung für alpine Forschungen und des Schweizerischen Vereins zur Förderung des World Wildlife Fund. Die Arbeit wurde ermöglicht durch die Forstdirektion des Kantons Bern, insbesondere Herrn Jagdinspektor H. SCHAERER. Berner Wildhüter halfen bei Einfang und Markierung. Die Abbildungen führte Herr R. SCHRANER aus. Die Herren Dr. A. BUBENIK und Dr. V. GEIST lasen Teile des Manuskriptes und gaben Hinweise.